

WHAT IS CLAIMED IS:

1. A method for determining the extent of recovery of materials injected into an oil well comprising:

- 5 a) admixing a material to be injected into an oil well with a chemical tracer compound at a predetermined concentration;
- b) injecting the admixture into an oil well or an offset well associated with an oil well;
- c) recovering from the oil well a production fluid;
- 10 d) analyzing the production fluid for a concentration of the chemical tracer present in the production fluid; and
- e) calculating the amount of admixture recovered from the oil well using the concentration of the chemical tracer present in the production fluid as a basis for the calculation.

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2. The method of Claim 1 wherein the tracer is selected from the group consisting of fluorinated benzoic acids, perfluoromethylcyclopentane (PMCP), perfluoromethylcyclohexane (PMCH), perfluorodimethylcyclobutane (PDMCB), m-perfluorodimethylcyclohexane (m-PDMCH), o-perfluoro-

20 dimethylcyclohexane (o-PDMCH), p-Perfluorodimethylcyclohexane (p-PDMCH), perfluorotrimethylcyclohexane (PTMCH), perfluoroethylcyclohexane (PECH), and perfluoroisopropylcyclohexane (IPPCH).

3. The method of Claim 2 wherein the tracer is a fluorinated benzoic acid.

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4. The method of Claim 3 wherein the fluorinated benzoic acid is selected from the group consisting of including 2-fluorobenzoic acid; 3-fluorobenzoic acid; 4-fluorobenzoic acid; 3,5-difluorobenzoic acid; 3,4-difluorobenzoic acid;

2,6-difluorobenzoic acid; 2,5-difluorobenzoic acid; 2,3-difluorobenzoic acid;
2,4-difluorobenzoic acid; pentafluorobenzoic acid; 2,3,4,5-tetrafluorobenzoic
acid; 4-(trifluoro-methyl)benzoic acid; 2-(trifluoromethyl)benzoic acid; 3-
(trifluoro-methyl)benzoic acid; 3,4,5-trifluorobenzoic acid; 2,4,5-
5 trifluorobenzoic acid; 2,3,4-trifluorobenzoic acid; 2,3,5-trifluorobenzoic acid;
2,3,6-trifluorobenzoic acid; and 2,4,6-trifluorobenzoic acid.

5. The method of Claim 1 wherein the tracer is present in the admixture
injected into an oil well at a concentration of at least about 1 part per trillion.

10 6. The method of Claim 5 wherein the tracer is present in the admixture
injected into an oil well at a concentration of less than or equal to 10,000
parts per million.

15 7. The method of Claim 6 wherein the tracer is present in the admixture
injected into an oil well at a concentration of from about 100 parts per trillion
to about 100 parts per million.

20 8. The method of Claim 1 wherein the material injected into the oil well is
a hydraulic fracturing fluid

9. The method of Claim 1 wherein the material injected into the oil well is
a chemical stimulation fluid

25 10. The method of Claim 1 wherein the amount of injected admixture
recovered is determined using the formula:

$$AMT_r = ((T_r/T_i) \times AMT_i)$$

Wherein:

- (i) AMT_r is the amount of injected admixture recovered,
- (ii) T_i is the amount of tracer injected;
- (iii) T_r is the amount of tracer recovered;
- (iv) AMT_i is the amount of admixture injected; and
- 5 (v) T_r is determined by multiplying the concentrations of the tracer in the production fluid by the total quantity of production fluid recovered.

11. The method of claim 1 wherein the tracer is in the form of a coating on a solid support.

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12. The method of claim 1 wherein the tracer is in the form of a liquid or solid within the pores of a porous support.

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13. The method of claim 1 wherein the tracer is in the form of an encapsulated liquid or solid.

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14. A method for determining the extent of recovery of a material of interest injected into an oil well or a subsurface formation associated with a bore of the oil well comprising:

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- a) introducing a material of interest into the oil well or into the subsurface formation associated with the bore of the oil well;
- b) introducing a tracer into the oil well or into the subsurface formation associated with the bore of the oil well;
- c) recovering from the oil well a production fluid;
- d) analyzing the production fluid for a concentration of the chemical tracer present in the production fluid; and

e) calculating the amount of material of interest recovered from the oil well using the concentration of the chemical tracer present in the production fluid as a basis for the calculation.

5 15. The method of Claim 14 wherein the tracer is a fluorinated benzoic acid.

16. The method of Claim 15 wherein the fluorinated benzoic acid is selected from the group consisting of including 2-fluorobenzoic acid; 3-
10 fluorobenzoic acid; 4-fluorobenzoic acid; 3,5-difluorobenzoic acid; 3,4-difluorobenzoic acid; 2,6-difluorobenzoic acid; 2,5-difluorobenzoic acid; 2,3-difluorobenzoic acid; 2,4-difluorobenzoic acid; pentafluorobenzoic acid; 2,3,4,5-tetrafluorobenzoic acid; 4-(trifluoro-methyl)benzoic acid; 2-(trifluoromethyl)benzoic acid; 3-(trifluoro-methyl)benzoic acid; 3,4,5-
15 trifluorobenzoic acid; 2,4,5-trifluorobenzoic acid; 2,3,4-trifluorobenzoic acid; 2,3,5-trifluorobenzoic acid; 2,3,6-trifluorobenzoic acid; and 2,4,6-trifluorobenzoic acid.

17. The method of Claim 16 wherein the tracer is introduced into the oil
20 well or subsurface formation through the oil well.

18. The method of Claim 16 wherein the tracer is introduced into the oil well or subsurface formation through an offset well.

25 19. The method of Claim 16 wherein the material of interest is introduced into the oil well or subsurface formation through the oil well.

20. The method of Claim 16 wherein the material of interest is introduced into the oil well or subsurface formation through an offset well.

21. The method of Claim 14 wherein the amount of material of interest
5 recovered is determined using the formula:

$$AMT_r = ((T_r/T_i) \times AMT_i)$$

Wherein:

- (i) AMT_r is the amount of material of interest recovered,
- (ii) T_i is the amount of tracer injected;
- 10 (iii) T_r is the amount of tracer recovered;
- (iv) AMT_i is the amount of material of interest injected; and
- (v) T_r is determined by multiplying the concentrations of the tracer in the production fluid by the total quantity of production fluid recovered.

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